TJHSST Senior Research Project
Exploring Artificial Societies Through Sugarscape
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Abstract

The intent of this project is to apply a computer based approach to the modeling of an artificial society of a sugarscape. Much previous research has been done on this topic, and many programmers are working toward reliable models of actual societies of today and the past. Using Netlogo and MASON to simulate these societies, I hope to develop a complex system in the sugarscape that involves the dynamics of distinct groups in the form of social networks or neighborhoods or separate races to discover what factors influence these complex dynamics.

Keywords: genetic algorithms, algorithmic composition

1 Introduction - Problem Statement and Purpose

1.1 What is research

Agent based modeling is an important field in computer science. One of its numerous applications, artificial societies, can help researchers to better understand the complexities of numerous social situations. This sugarscape

is intended to show the movement of individuals toward a source of food. These individuals are limited in their vision, though it varies. With this limited vision, they search for and move to the best possible area of sugar. This movement is relatively predictable and is largely influenced by the topography of the sugarscape. This society can be expanded to include more complex behavior, such as migration and combat.

This sort of modeling can be used to attempt to understand a variety of societal behaviors. It can be applied to neighborhoods and poverty traps, to the modeling of ancient societies, to migration. These models may provide a better understanding of patterns in a society, and will be of value to sociological studies.

1.2 Why is research done?

Two basic purposes of research are to learn something and/or to gather evidence. Research also advances existing knowledge in a discipline, subject area or field. It fills significant gaps in such knowledge and is used to devise new modes or means of expression.

New perspectives in sciences, arts and humanities can be developed.

2 Background

Background Agent based modeling is a common method to solve complex problems of emergence and evolution. Sugarscape is an artificial society model that has been used by a number of people. Ive been specificially using the book Growing Artificial Societies: Social Science from the Bottom Up by Epstein and Axtell their research into sugrascapes is quite extensive. Their algorithms for movement and regrowth are very basic and fundamental for the functioning sugarscape. Each time step, an agent looks for the best possible patch of sugar within its vision and moves toward it, and each time step, the grass will be regrown, either to its full capacity in one step, or partially over several time steps.

Srbljinovic, Penzar, Rodik and Kardov used agent based modeling to better understand the socio-ethnic patterns in Yugoslavia (2003) in An Agent-Based Model of Ethnic Mobilisation. In this model, they created agents possessing ethnicity and grievances who were given appeals, as they would

be by politicians in Yugoslavie, and traced the mobilization of these groups over time using a Java version of SWARM.

3 Development Sections

As of now, my model is a sugarscape populated by turtles who search for the best food source. It was created using the guidelines of Growing Artificial Societies and is designed in Netlogo. At some point, I intend to reprogram the problem using MASON to allow more versatility. At this point, there are not mathematical formulas in place to measure the distribution or movement of the turtles; they are simply moving about. There are two basic methods at this point: move and regrow. Movement requires the turtle to scan the terrain within its vision for larger sources of sugar. Once the largest source of sugar is located, the turtle moves to that location. Upon moving, the turtles eat the sugar. Regrowth is the process by which the sugar is replenished. It is regrown every two steps. My testing and analysis is limited because of an absence of mathematical formulas, though at some point in my research, I will assess the progress of this society using formulas and tests.

The data is represented by a green topographical sugarscape and multi-colored turtles, actually arrows. At each time step, the turtles move and some grass is eaten or replenished. The sugarscape could be reproduced by reproducing some of the algorithms in Growing Artificial Societies.

4 Quality Assessment (QA), Validation of program's performance

Thus far, movement and regrowth are the only two factors being tested. Testing is seriously constrained due to lack of mathematical formulas, and also due to the fact that all input and output is limited to clicking the Go and Set-up buttons. So far, the turtles are able to move about and eat sugar, however, they have a tendency to clump in the bottom lefthand corner.

5 Results, Discussion, Conclusion, Recommendations (End matter for your paper)

This project is intended to provide information about society be modeling the behavior of an artificial society. I still have many complexities to add to the program, and at that point, it will be even more useful. The turtles tend to clump at the area with the most sugar. However, the turtles with less vision are severely disadvantaged and often get stuck in a low-sugar area because of lack of knowledge about other opportunities.

6 Conclusion

This project is intended to model and artificial society. Using Netlogo, and later MASON, I have created a sugarscape whose individuals scan the landscape for the area with the most available sugar. The project is based on the sugarscape as presented in the book Growing Artificial Societies by Epstein and Axtell. The project still needs significant additons before it will be especially useful. Hopefully, it will be a building block for understanding complex behaviors of communities. For further reading, I would recommend reading some of the Santa Fe Institutes articles on social development using computer models.